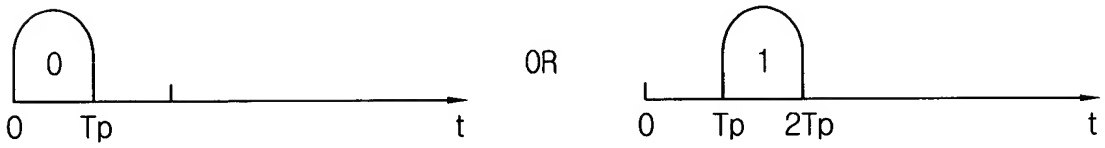
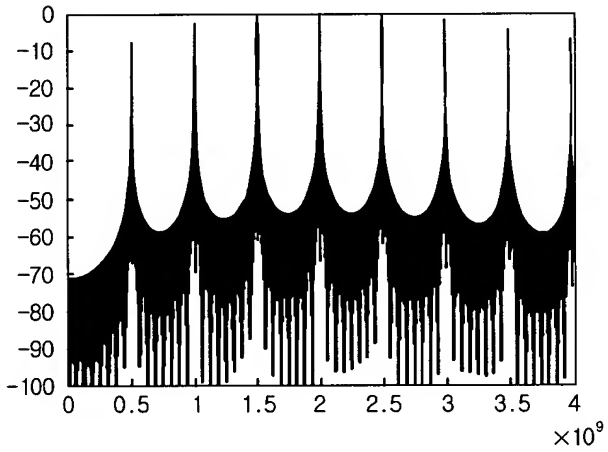
# FIG. 1
# (PRIOR ART)

(a)




(b)




(c)

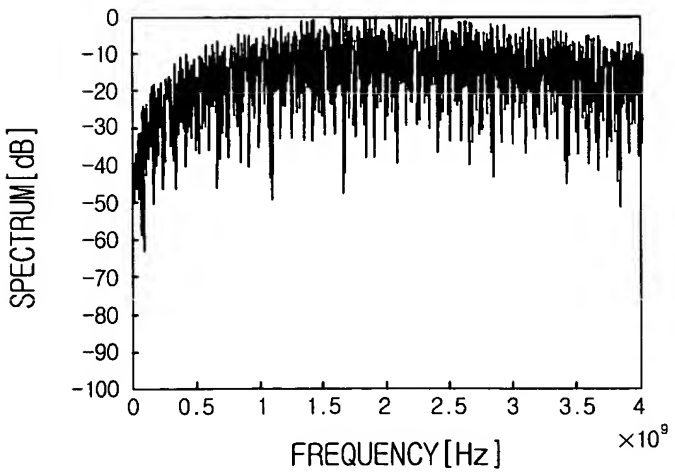


FIG. 2
(PRIOR ART)

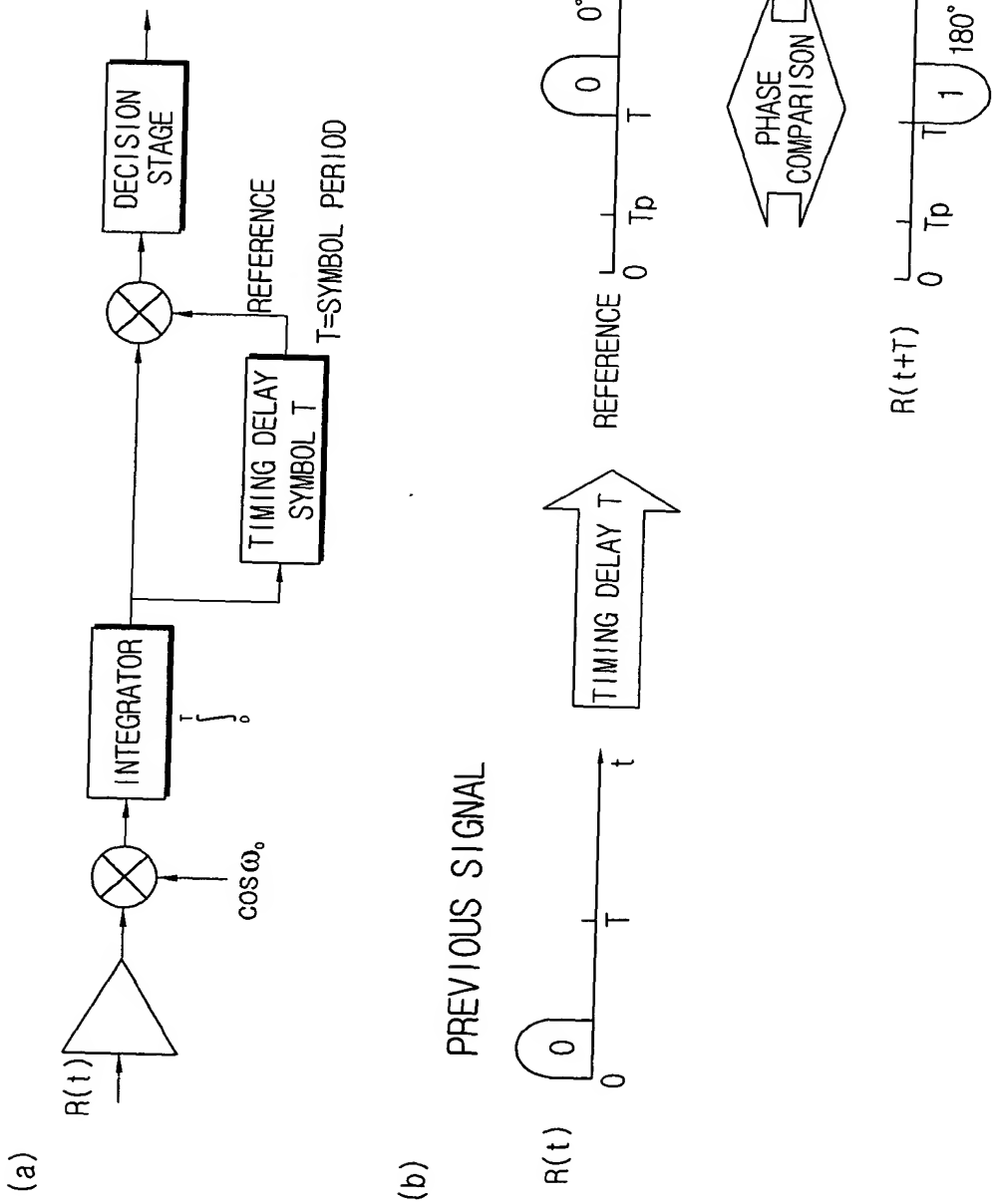


FIG. 3A

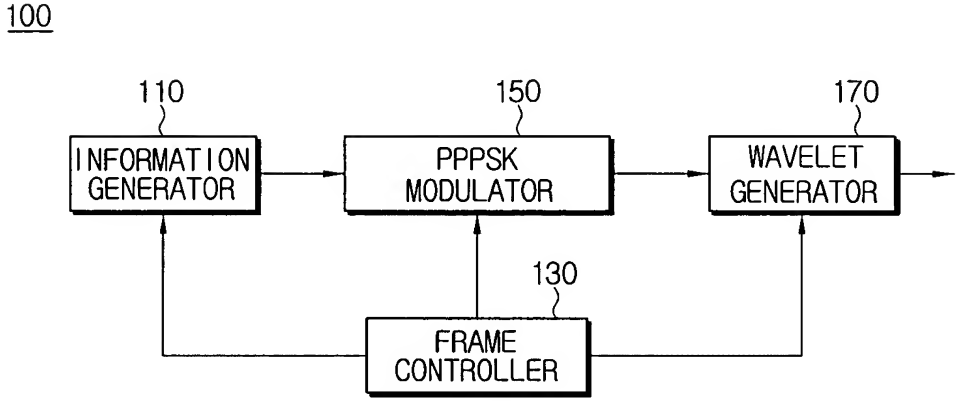

100
110
150
170
INFORMATION GENERATOR
PPPSK MODULATOR
WAVELET GENERATOR
130
FRAME CONTROLLER

FIG. 3B

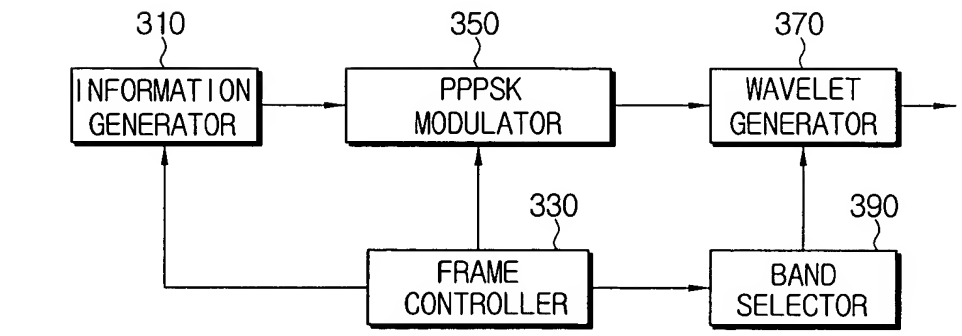

300
310
350
370
INFORMATION GENERATOR
PPPSK MODULATOR
WAVELET GENERATOR
330
390
FRAME CONTROLLER
BAND SELECTOR

FIG. 4A

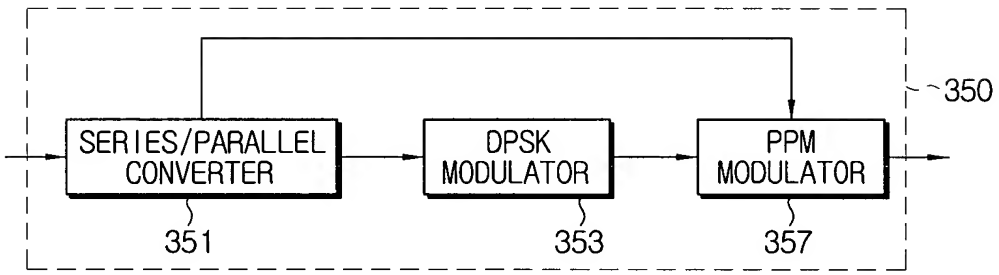



FIG. 4B

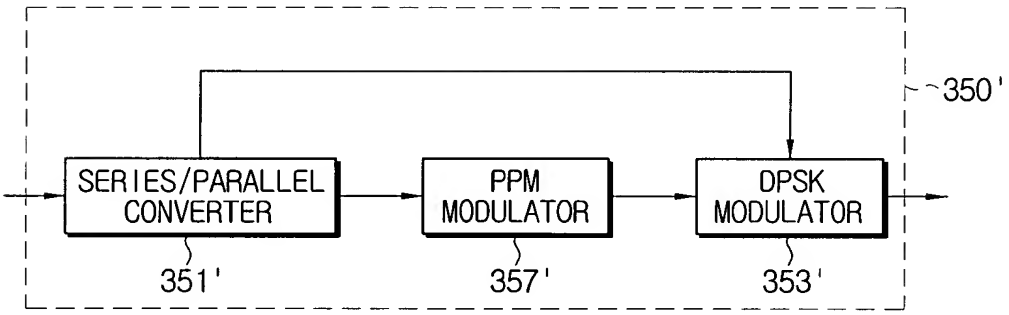
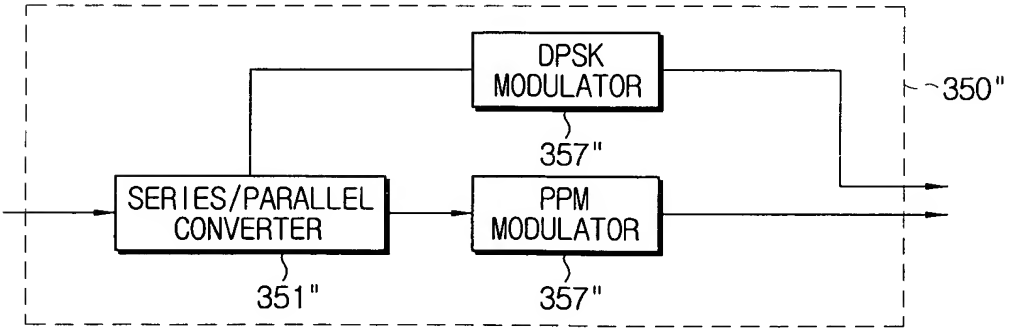
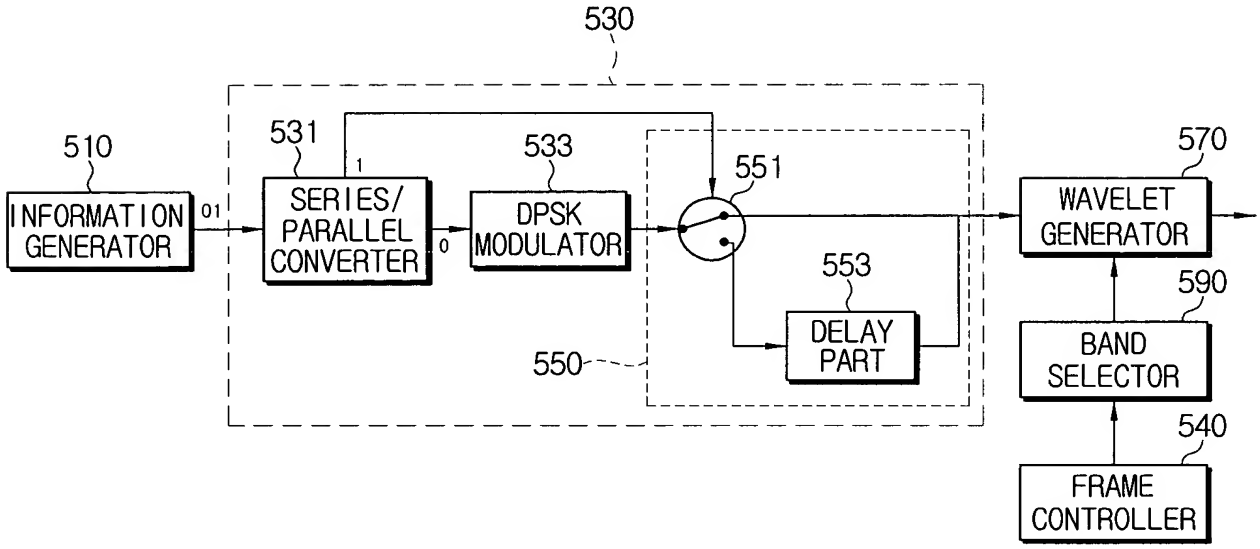


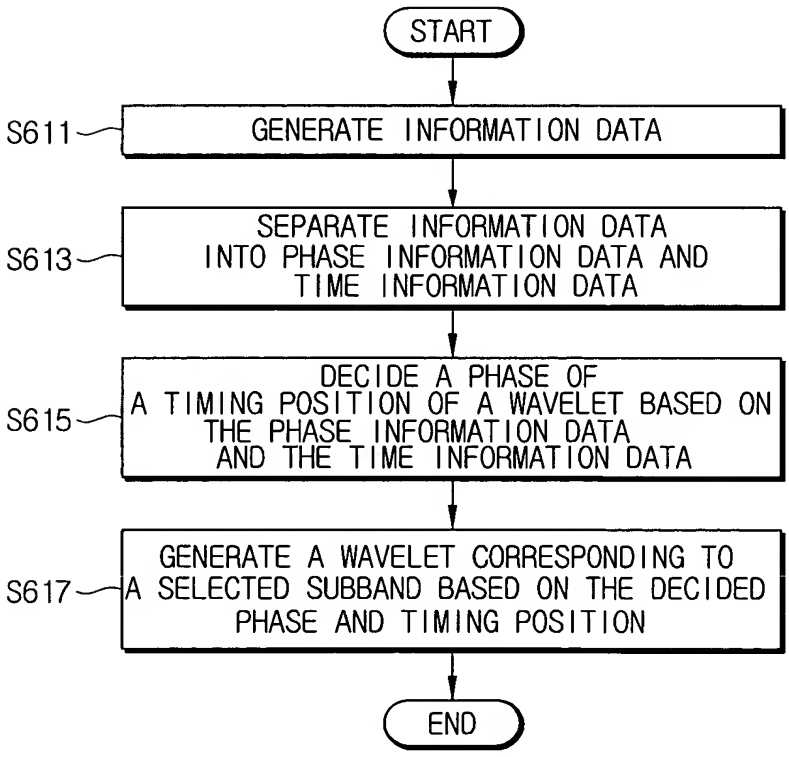

FIG. 4C



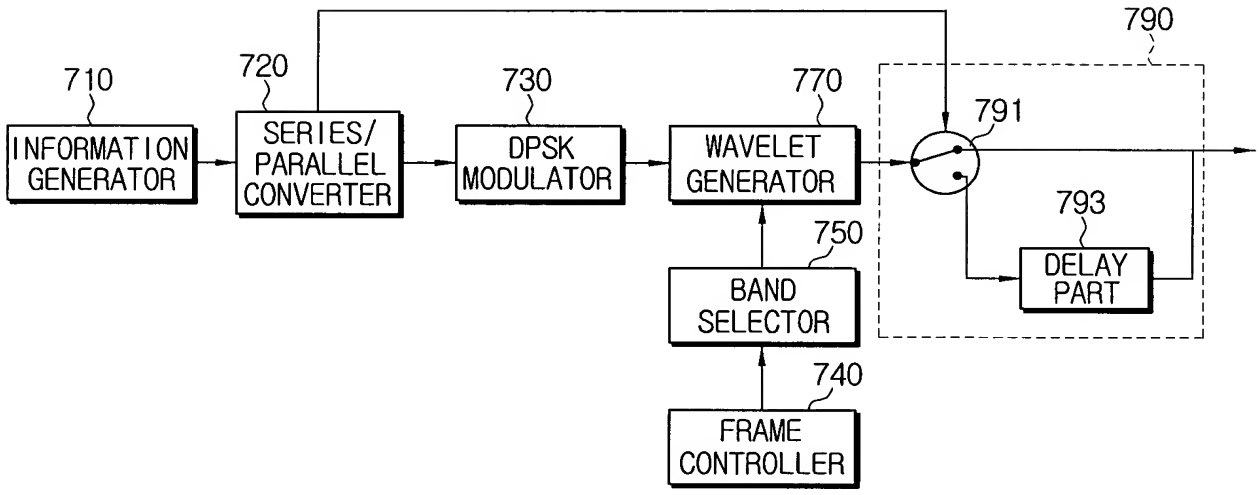
# FIG. 5


530
510
INFORMATION GENERATOR
01
531
1
SERIES/ PARALLEL CONVERTER
0
533
DPSK MODULATOR
551
553
DELAY PART
550
570
WAVELET GENERATOR
590
BAND SELECTOR
540
FRAME CONTROLLER

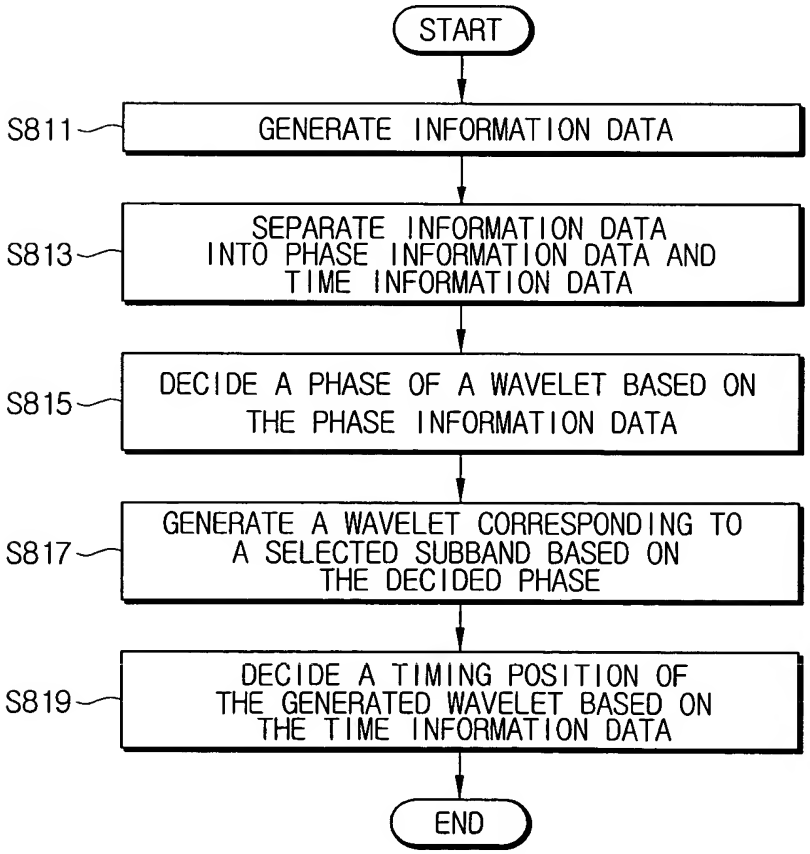
# FIG. 6


START
S611
GENERATE INFORMATION DATA
S613
SEPARATE INFORMATION DATA INTO PHASE INFORMATION DATA AND TIME INFORMATION DATA
S615
DECIDE A PHASE OF A TIMING POSITION OF A WAVELET BASED ON THE PHASE INFORMATION DATA AND THE TIME INFORMATION DATA
S617
GENERATE A WAVELET CORRESPONDING TO A SELECTED SUBBAND BASED ON THE DECIDED PHASE AND TIMING POSITION
END

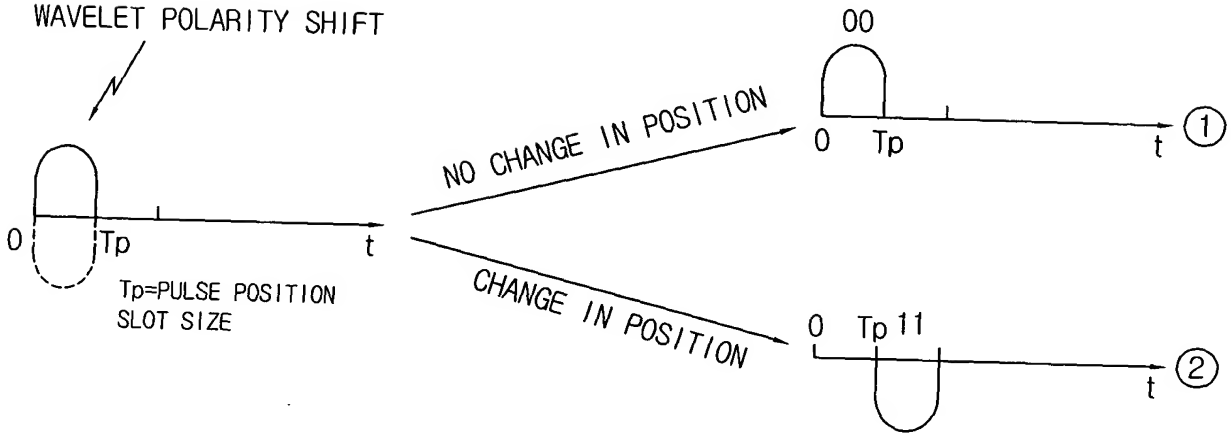
# FIG. 7


710
INFORMATION GENERATOR
720
SERIES/ PARALLEL CONVERTER
730
DPSK MODULATOR
770
WAVELET GENERATOR
790
791
793
DELAY PART
750
BAND SELECTOR
740
FRAME CONTROLLER

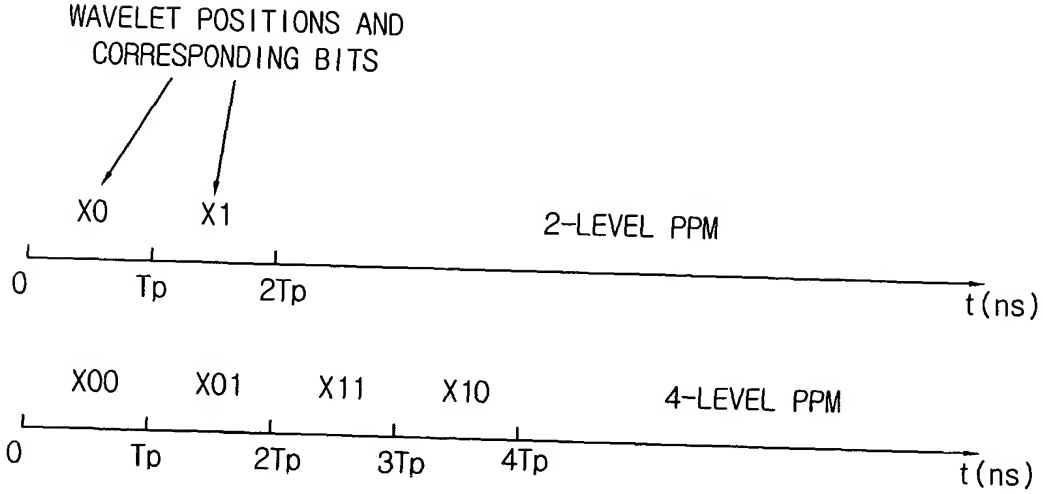
# FIG. 8


START
S811
GENERATE INFORMATION DATA
S813
SEPARATE INFORMATION DATA INTO PHASE INFORMATION DATA AND TIME INFORMATION DATA
S815
DECIDE A PHASE OF A WAVELET BASED ON THE PHASE INFORMATION DATA
S817
GENERATE A WAVELET CORRESPONDING TO A SELECTED SUBBAND BASED ON THE DECIDED PHASE
S819
DECIDE A TIMING POSITION OF THE GENERATED WAVELET BASED ON THE TIME INFORMATION DATA
END

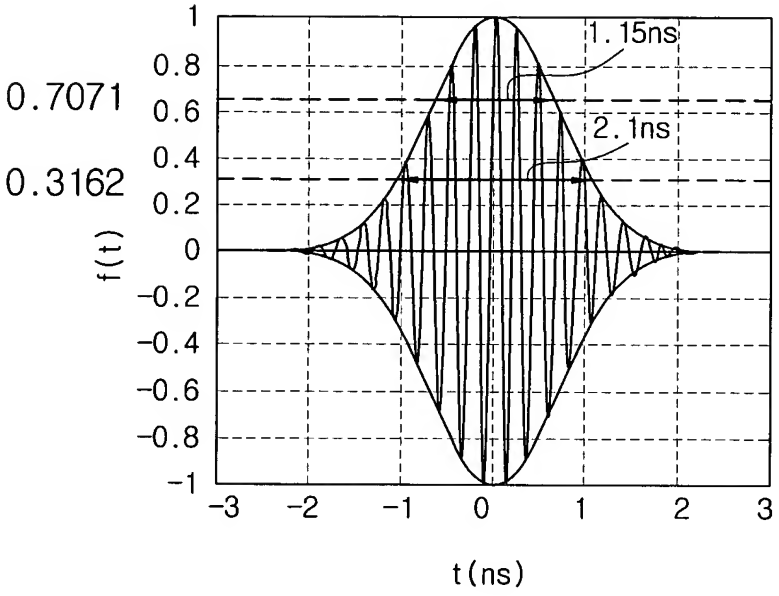
# FIG. 9A


WAVELET POLARITY SHIFT
0
Tp
t
Tp=PULSE POSITION
SLOT SIZE
NO CHANGE IN POSITION
CHANGE IN POSITION
00
0 Tp
t
①
0 Tp 11
t
②

# FIG. 9B

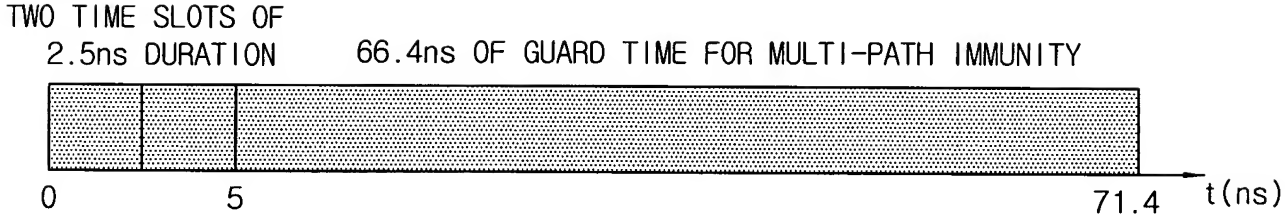

WAVELET POSITIONS AND
CORRESPONDING BITS
X0
X1
2-LEVEL PPM
0
Tp
2Tp
t(ns)
X00
X01
X11
X10
4-LEVEL PPM
0
Tp
2Tp
3Tp
4Tp
t(ns)

# FIG. 9C




WAVELET IN TIME DOMAIN

# FIG. 9D




BINARY PPM-APPLIED TIME FRAME STRUCTURE

FIG. 10A

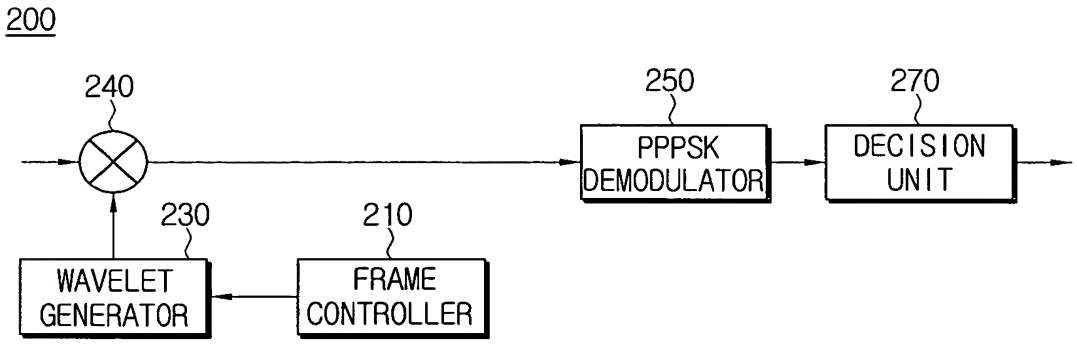



FIG. 10B

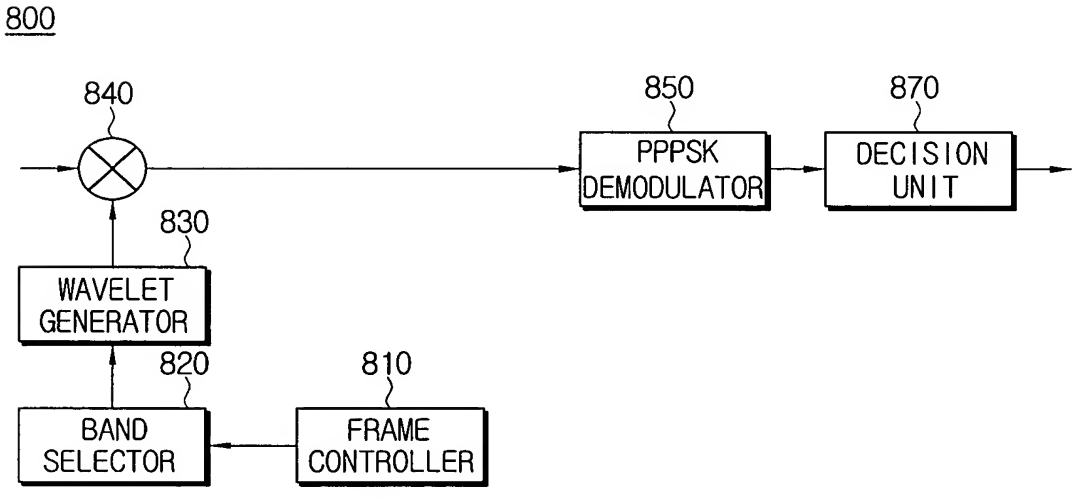
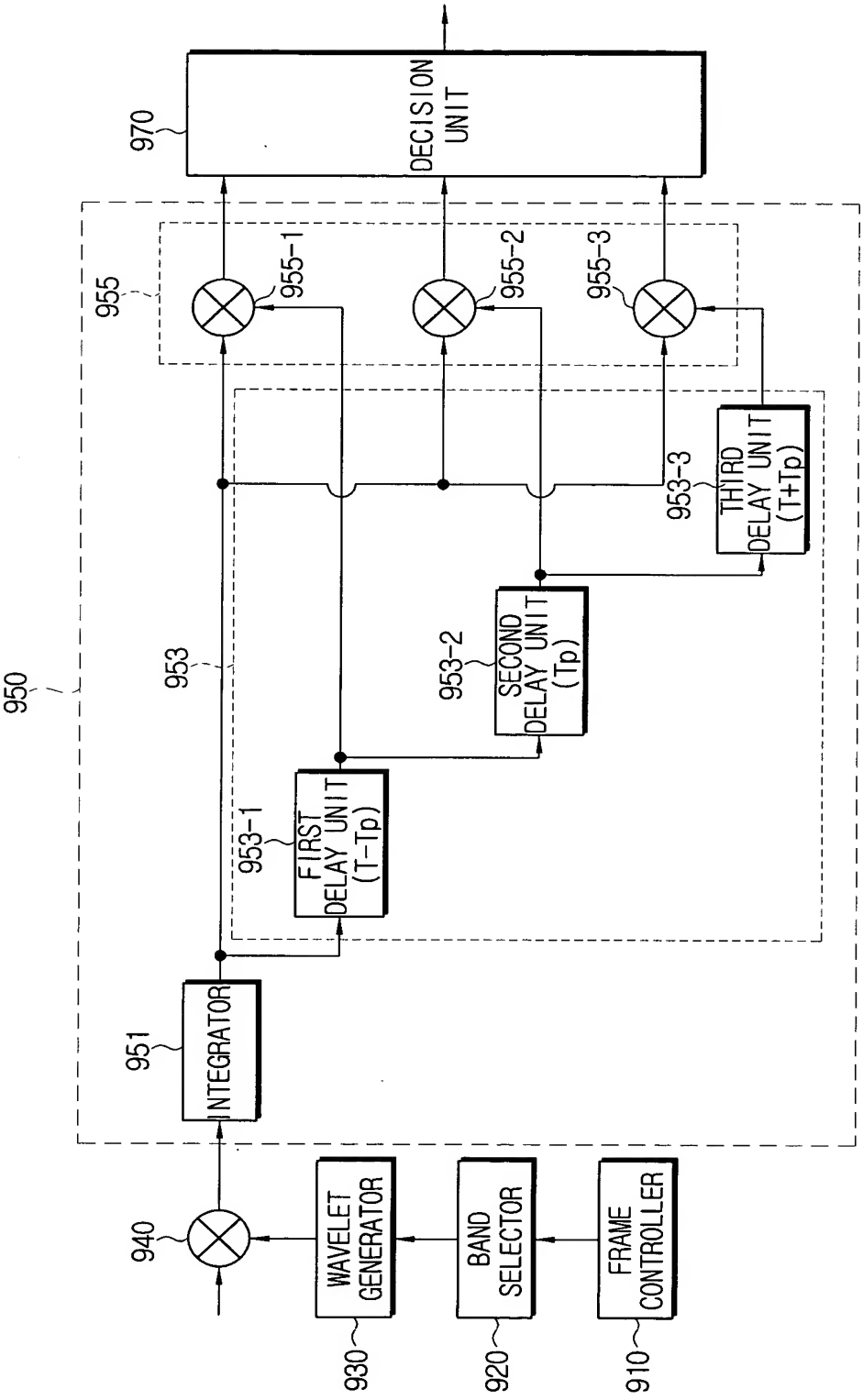
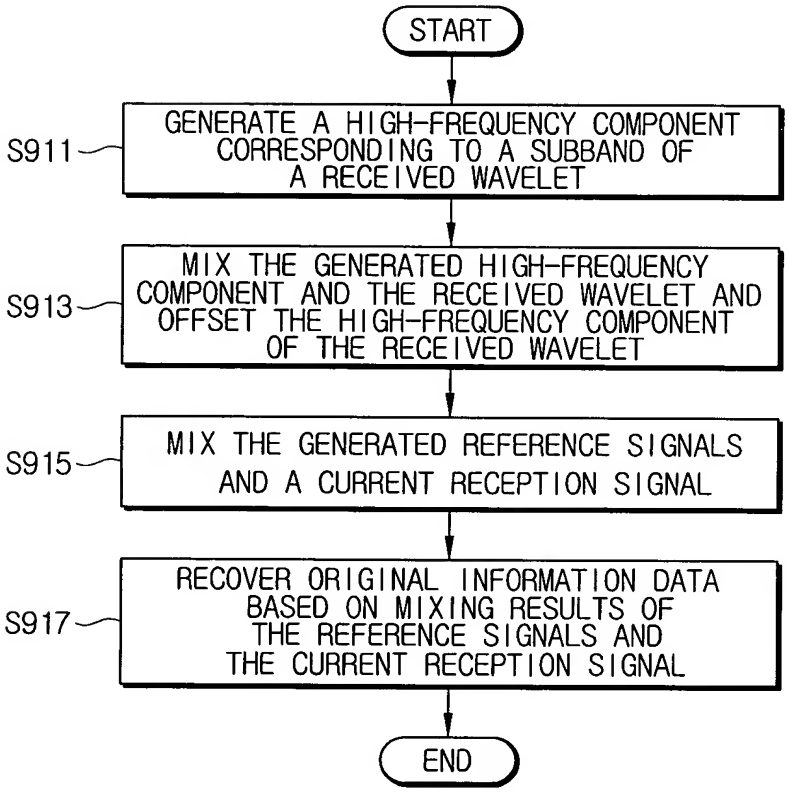


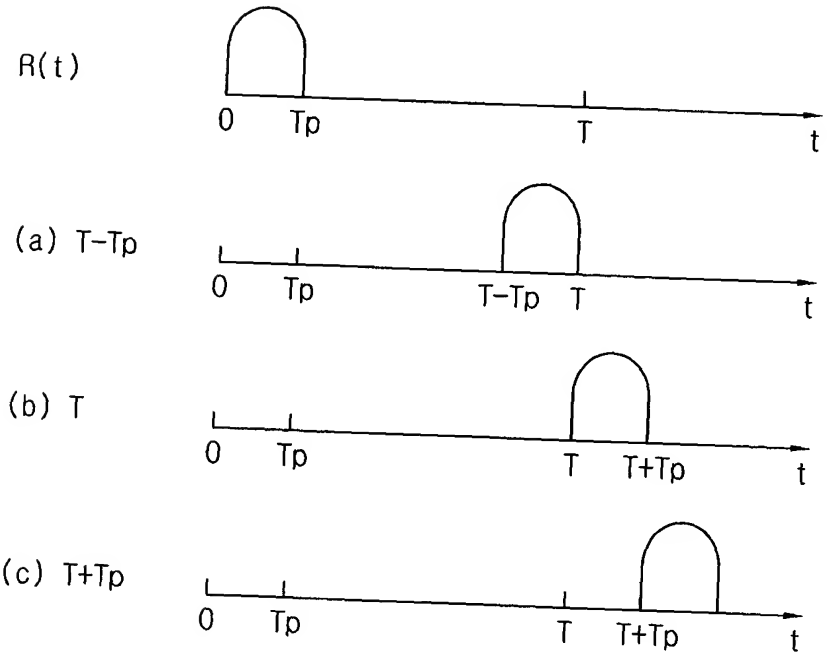
FIG. 11


970
DECISION UNIT
955
955-1
955-2
955-3
950
953
953-1
FIRST DELAY UNIT (T-Tp)
953-2
SECOND DELAY UNIT (Tp)
953-3
THIRD DELAY UNIT (T+Tp)
951
INTEGRATOR
940
930
WAVELET GENERATOR
920
BAND SELECTOR
910
FRAME CONTROLLER

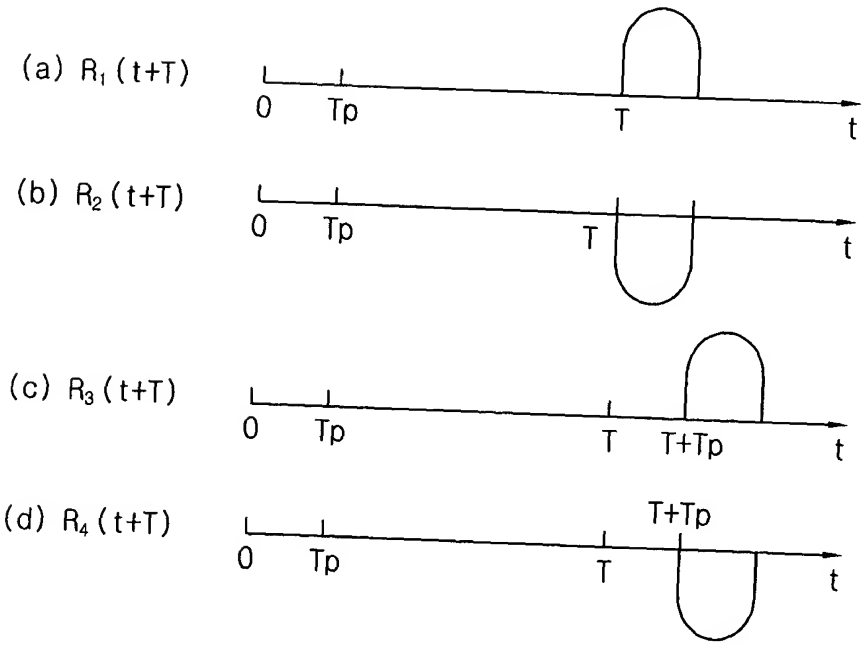
# FIG. 12


START
S911
GENERATE A HIGH-FREQUENCY COMPONENT CORRESPONDING TO A SUBBAND OF A RECEIVED WAVELET
S913
MIX THE GENERATED HIGH-FREQUENCY COMPONENT AND THE RECEIVED WAVELET AND OFFSET THE HIGH-FREQUENCY COMPONENT OF THE RECEIVED WAVELET
S915
MIX THE GENERATED REFERENCE SIGNALS AND A CURRENT RECEPTION SIGNAL
S917
RECOVER ORIGINAL INFORMATION DATA BASED ON MIXING RESULTS OF THE REFERENCE SIGNALS AND THE CURRENT RECEPTION SIGNAL
END

# FIG. 13


R(t)
0
Tp
T
t
(a) T-Tp
0
Tp
T-Tp
T
t
(b) T
0
Tp
T
T+Tp
t
(c) T+Tp
0
Tp
T
T+Tp
t

# FIG. 14


(a) $R_1(t+T)$
0
Tp
T
t
(b) $R_2(t+T)$
0
Tp
T
t
(c) $R_3(t+T)$
0
Tp
T
T+Tp
t
(d) $R_4(t+T)$
0
Tp
T
T+Tp
t